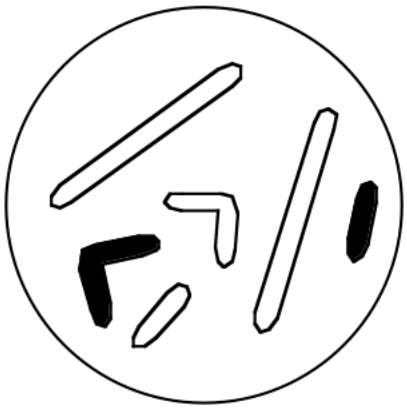
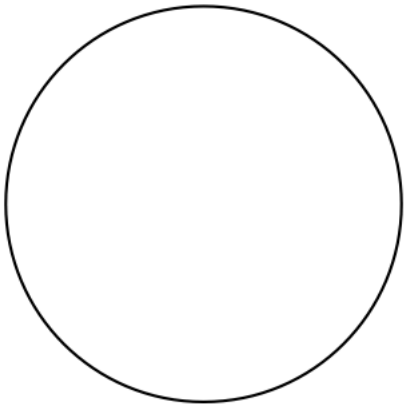
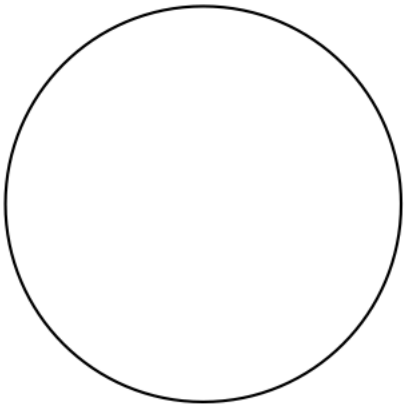
1.

The diagram below shows a diagram of a nucleus from a cell.



(a) Complete the diagrams to show the two nuclei which would be formed if the cell divided by **mitosis**. [1]





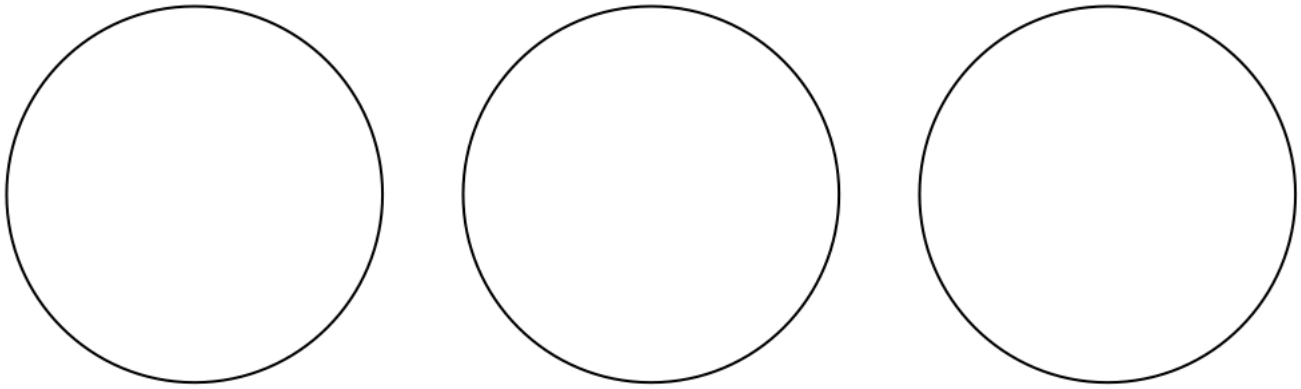
(b) (i) Give one example of a major site of **mitosis** in a plant. [1]

.....

(ii) Give an example of a site of **meiosis** in a plant. [1]

.....

(c) Complete the diagrams to show **three** different nuclei which could be formed if the cell divided by **meiosis**. (Assume that no crossing over has taken place). [3]



(d) (i) What is the stage between successive cell divisions called? [1]

.....

(ii) State **three** processes which must occur during this stage to prepare the cell for division. [3]

.....

.....

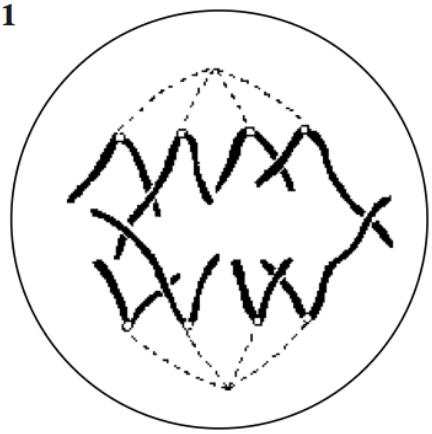
.....

(Total 10 marks)

2.

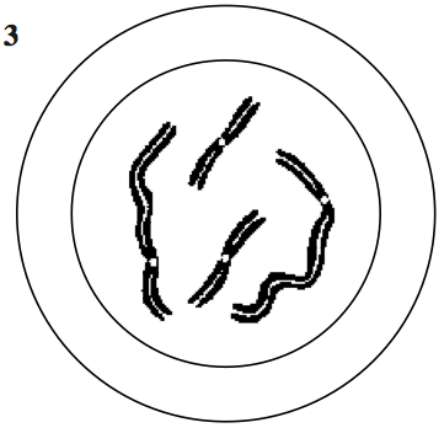
The simplified diagrams below show some of the main stages of mitosis, not in order.

1

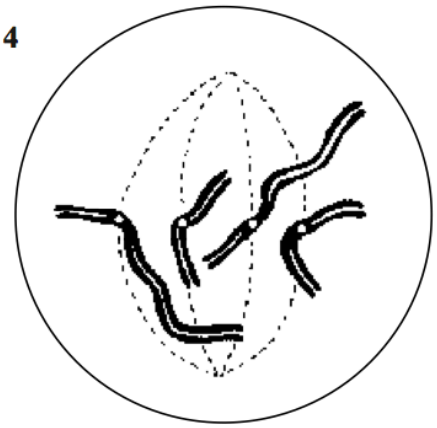


2

3



4



(a) State the name of each of the stages shown in the diagrams. [4]

1. .....

2. .....

3. .....

4. .....

(b) Using the numbers 1, 2, 3 and 4, place the stages into the correct sequence to show the process of cell division. [1]

....

(c) State **two** differences between this type of cell division and meiosis. [2]

.....

.....

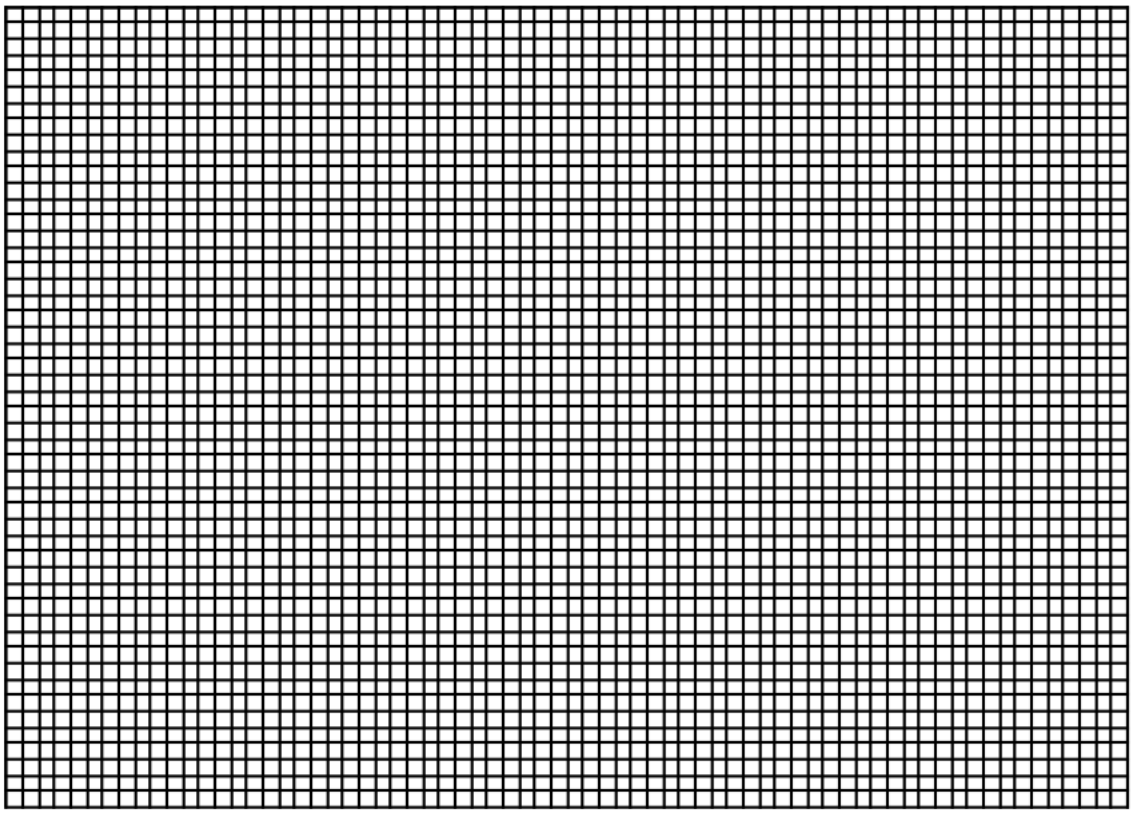
.....

.....

(d) The table below shows how the quantity of DNA varies with time in a cell cycle.

Time in hours	0	5	10	15	20	25	30
Quantity of DNA measured in arbitrary units	4	4	4	8	8	4	4

(i) Plot a graph of the data in the table, on the graph paper below. [3]



(ii) Explain fully the changes that have happened to the cell and why the quantity of DNA varies in this way. [3]

.....

.....

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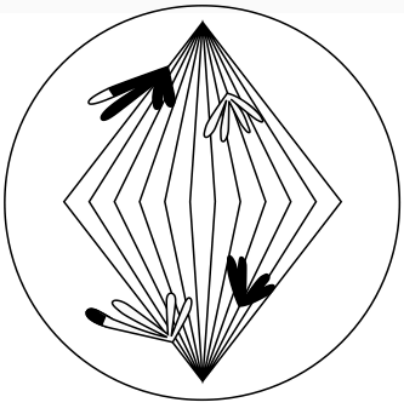
.....

.....

(Total 13 marks)

3.

(a) The diagram shows a stage in cell division.



(i) Name this type of cell division. [1]

.....

(ii) Give **two** reasons for your choice in *(a)*(i). [2]

.....

.....

.....

.....

(iii) Identify the stage of cell division seen in the diagram. [1]

.....

(b) Explain why the amount of DNA in the cell:

(i) is doubled during interphase; [1]

.....

.....

(ii) is reduced by half at cytokinesis. [1]

.....

.....

(c) Explain how meiosis can give rise to genetically variable gametes. [2]

.....

.....

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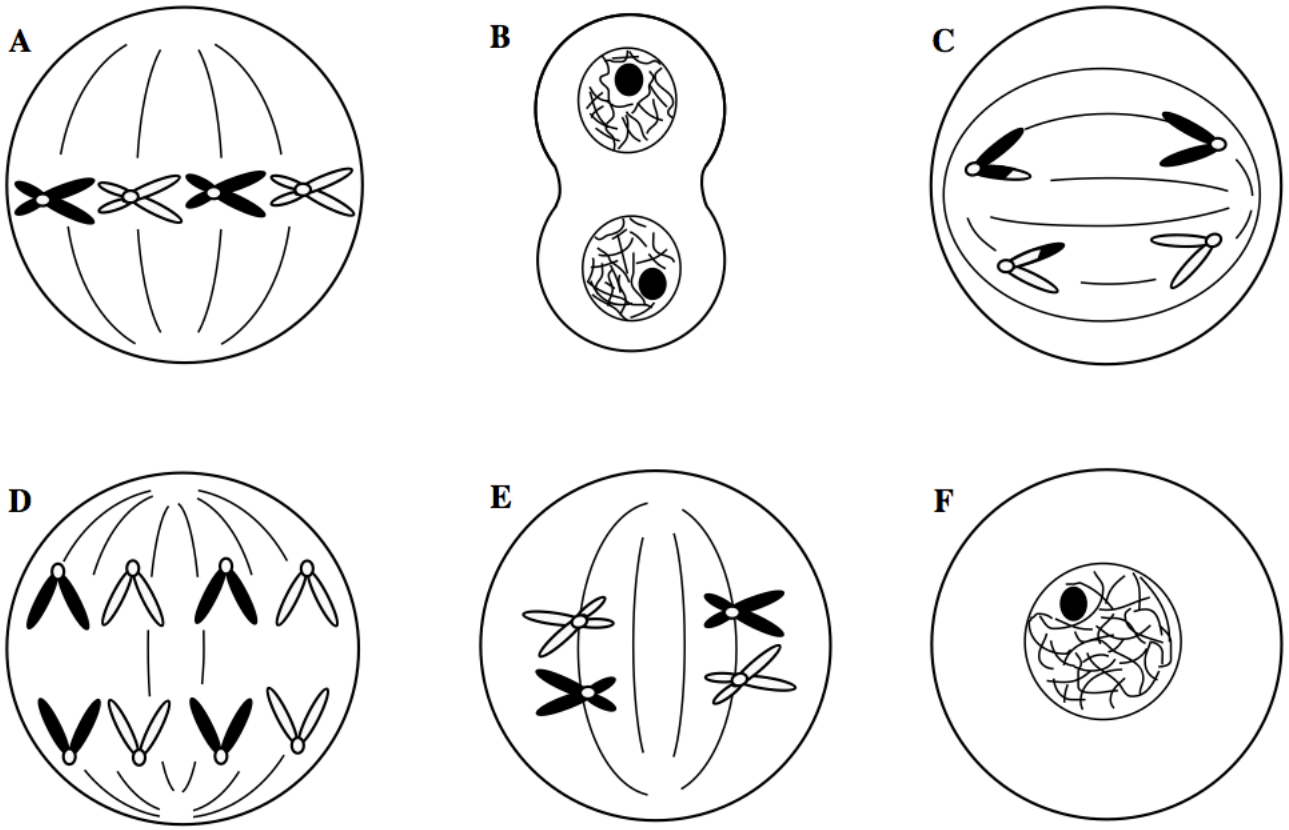
.....

.....

4.

The drawings show stages in cell division of an organism.



(a) Write a letter **A** to **F** to identify the diagram described by each of the phrases below. (Each letter may be used once, more than once or not at all.) [6]

(i) metaphase of mitosis .....

(ii) anaphase II of meiosis .....

(iii) cytokinesis .....

(iv) DNA replicates .....

(v) homologous pairs of chromosomes arranged across equator .....

(vi) chromosomes show that crossing over has occurred .....

(b) (i) What is the diploid number for this organism? ..... [1]

(ii) How many chromosomes would a gamete of this organism contain? ..... [1]

(c) Give **three** ways in which meiosis contributes to genetic variation. [3]

.....

.....

.....

.....

.....

.....

(Total 11 marks)

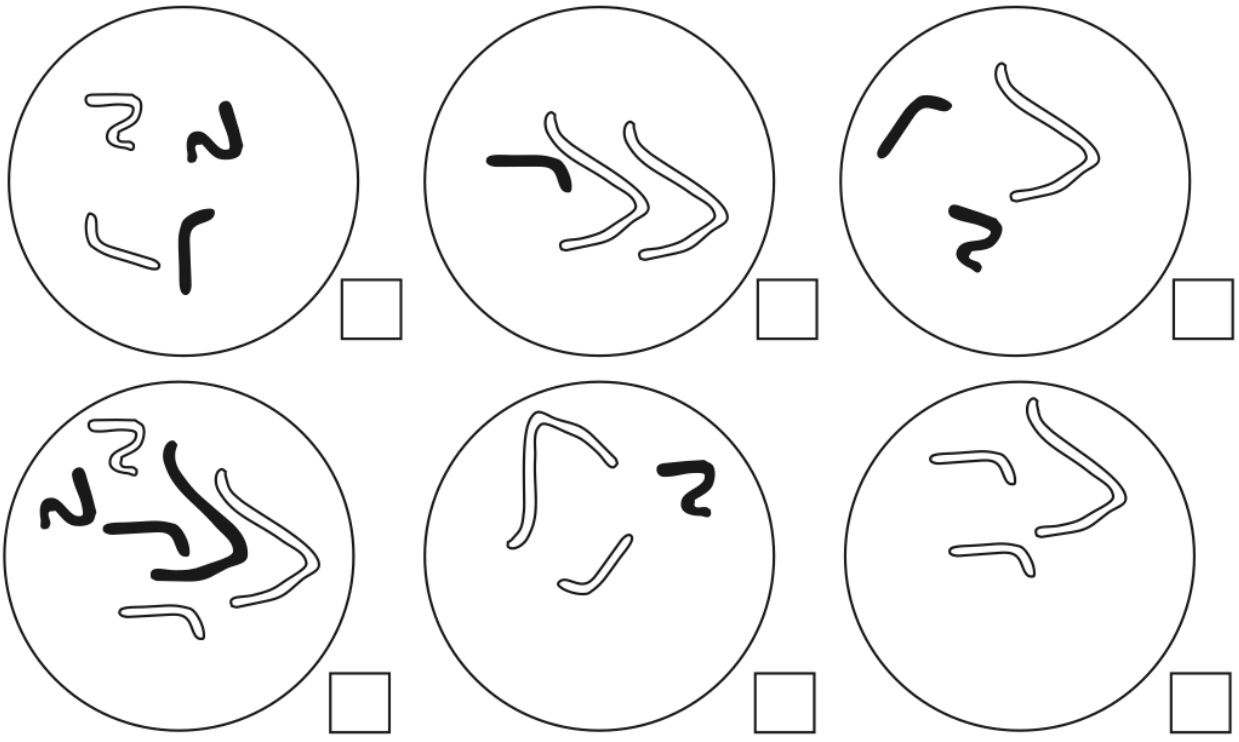
5.

3. The drawing below shows pairs of chromosomes inside a nucleus, which is about to divide by meiosis.

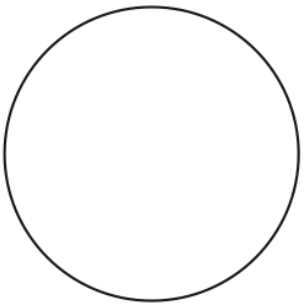
(a) How many chromosomes will there be in each daughter cell after the above cell completes dividing by meiosis? [1]

.....

(b) (i) Indicate with a tick (✓) in the box(es) which of the drawings below could be the nuclei of the daughter cells after meiosis. [2]



(ii) In the space below draw another nucleus that could result from this meiotic division. [1]



(iii) What is the biological significance of this type of division? [2]

.....

.....

.....

.....

.....

(c) (i) Complete the table below to show three differences that would be observed when comparing the stages (phases) of **meiosis 1** and mitosis. [3]

Meiosis I	*Mitosis*
1	1
2	2
3	3

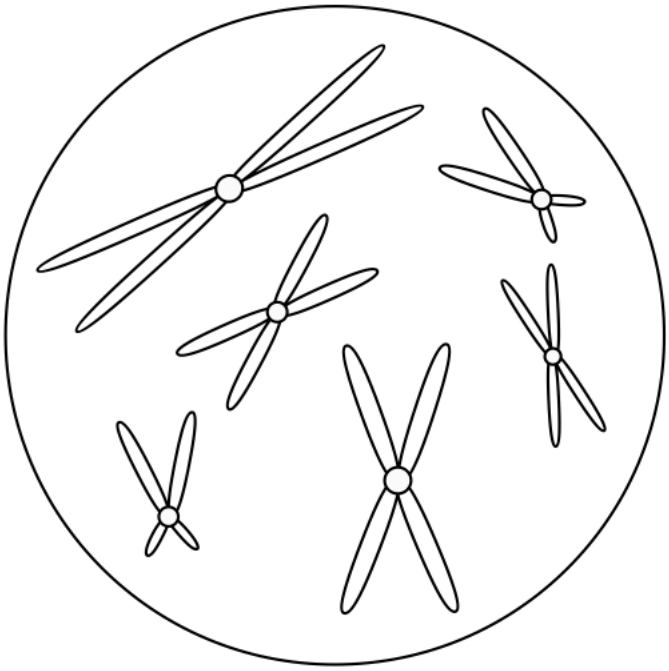
(ii) In which phase of the cell cycle does DNA replication occur? [1]

.....

(Total 10 marks)

6.

The diagram represents the nucleus of an animal cell (2n = 6) at early prophase of mitosis.



(a) In the space below draw an annotated diagram to indicate what happens to this cell at anaphase of mitosis. [4]

(b) What events must occur during interphase before mitosis can take place? [3]

.....

.....

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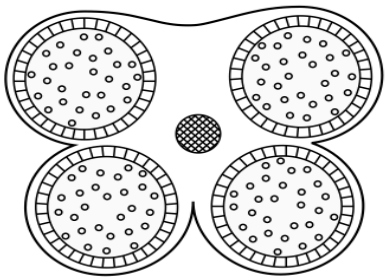
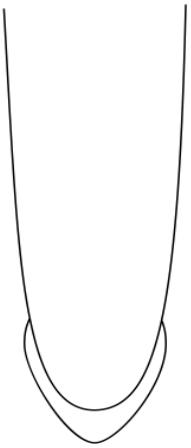
.....

(Total 7 marks)

7.

Below are two diagrams showing parts of a plant.





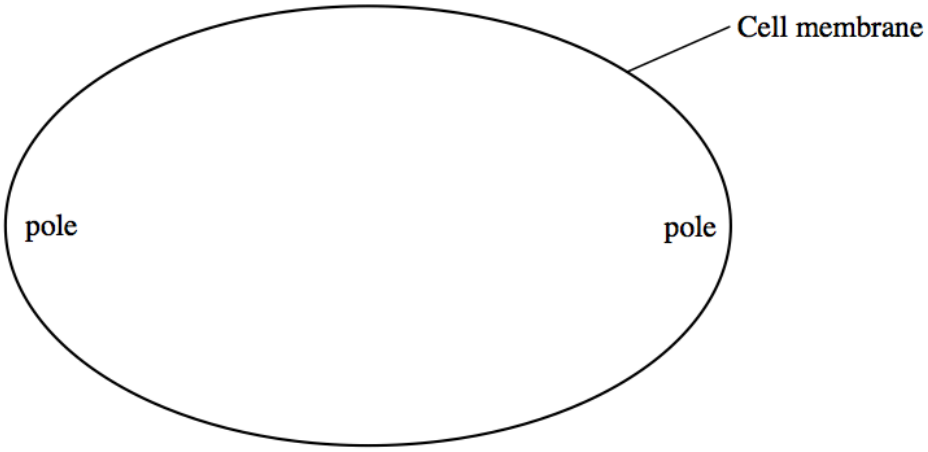
(a) (i) On **each** diagram draw a large cross to show the areas of cell division. [2]

(ii) In the boxes provided, name the type of cell division taking place. [2]

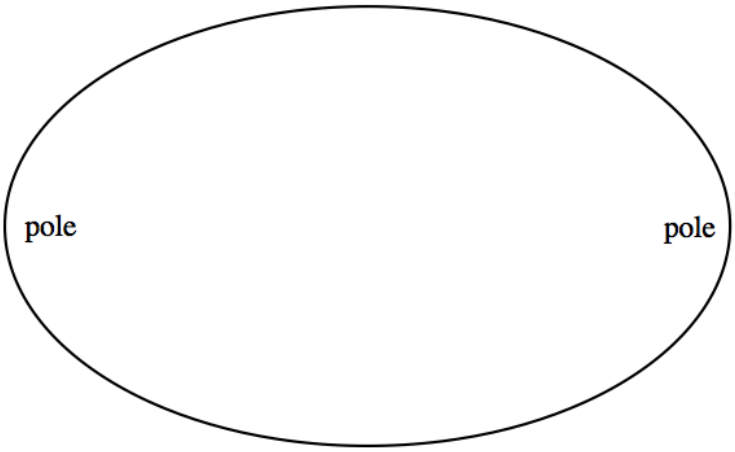
(b) (i) Complete the three diagrams on page 7, to show the arrangement of chromosomes at the named stages of cell division in an animal cell.
The original cell contained **2 pairs of chromosomes.** [3]

(ii) Label on any appropriate diagram
1. A centriole
2. A centromere
3. A bivalent [3]

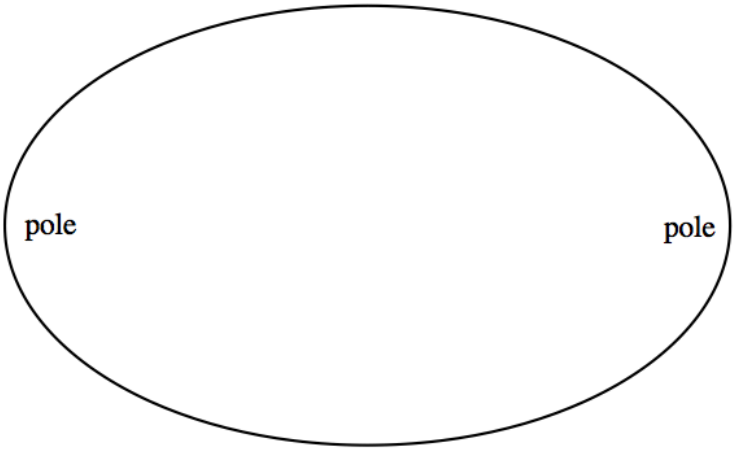
Metaphase of mitosis



Metaphase I of meiosis



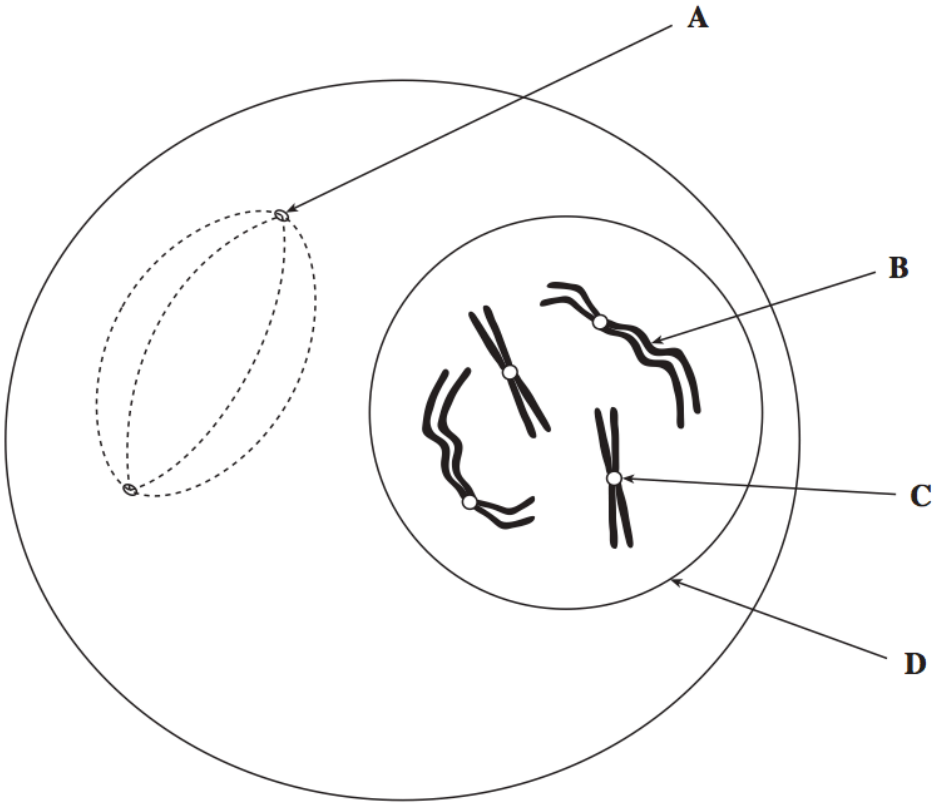
Metaphase II of meiosis



(Total 10 Marks)

8.

The diagram shows a stage in cell division.



(a) Name the structures labelled: [4]

A .....

B .....

C .....

D .....

(b) Name the phase shown. [1]

.....

(c) (i) Name the type of division shown. [1]

.....

(ii) Give **one** reason for your answer to *(c)*(i). [1]

.....

(d) State **one** biological function of this type of division. [1]

.....

(e) The diagram shows an early stage in this phase. A diagram drawn at the **end** of this phase would show several changes.
Give **three** of these changes. [3]

1. .....

.....

2. .....

.....

3. .....

.....

(f) Is the cell shown an animal cell or a cell from a higher plant?
Use your knowledge of cell division to explain your choice. [2]

.....

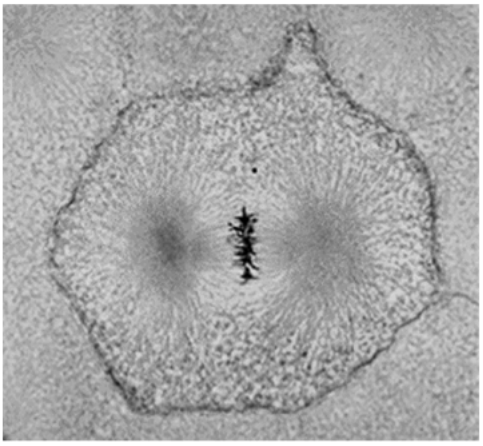
.....

(Total 13 marks)

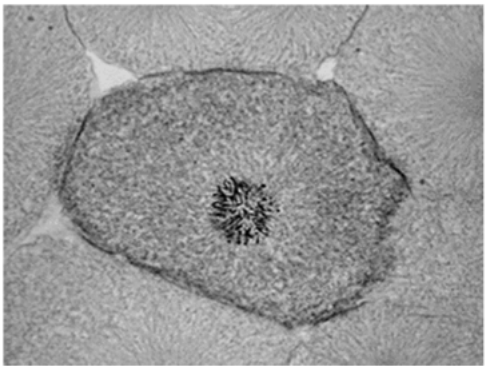
9.

The photographs **A** to **D** below show the four stages in the process of mitosis.

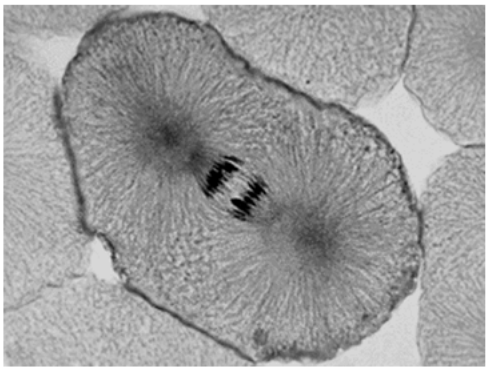
A



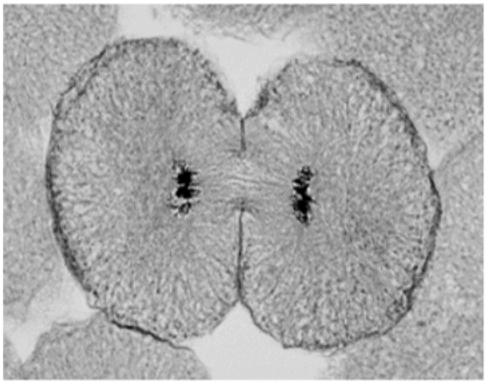
B



C



D



(a) Place the letters of these diagrams in the correct sequence in which the stages occur. [2]

....

(b) Name the stage of mitosis during which the following occur.

(i) Chromatids can first be seen using a light microscope. [1]

.....

(ii) Nuclear envelope disappears. [1]

.....

(iii) Pairs of chromatids become attached to their spindle fibres, by their centromeres, at the equator. [1]

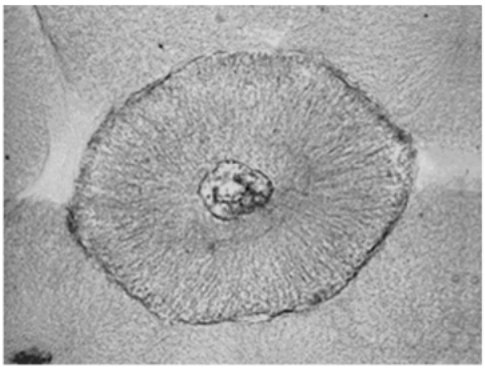
.....

(iv) Chromatids become chromosomes. [1]

.....

(c) Photograph **E** shows a cell during a part of the cell cycle called interphase. This is often called the 'resting phase'.

E



Explain why it is incorrect to regard the cell as 'resting' during interphase. [3]

.....

.....

.....

(d) What is the significance of mitosis and why is it important to plants? [3]

.....

.....

.....

.....

(e) Meiosis is used to produce gametes for sexual reproduction in mammals.

Give **three** ways in which meiosis leads to variation in offspring. [3]

.....

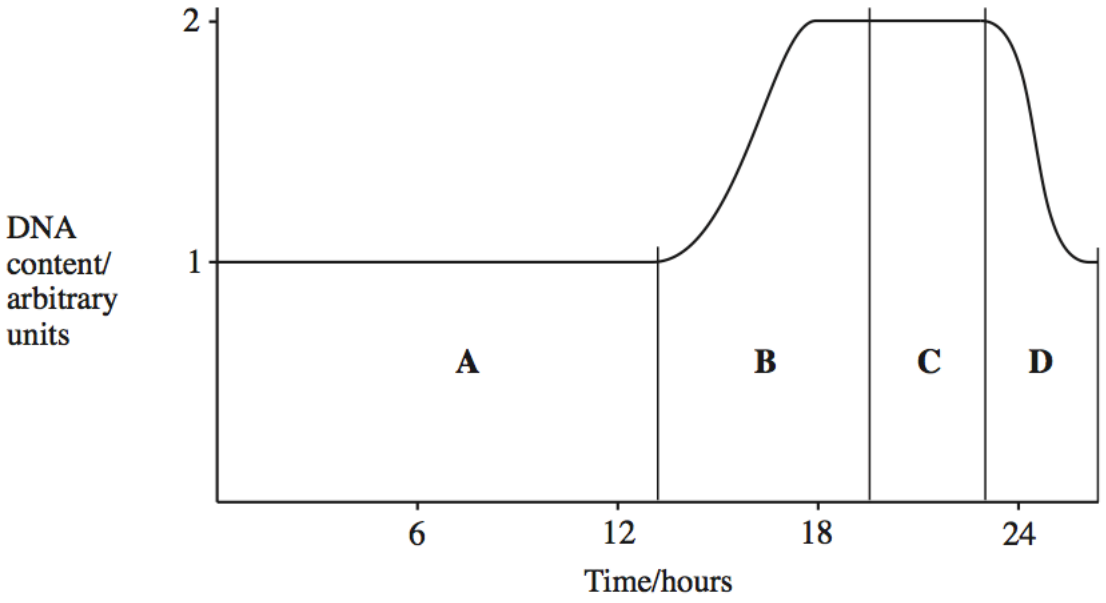
.....

.....

(Total 15 marks)

10.

Most cells go through a cyclic process of growth and division. The diagram below shows the changes in DNA content during one cell cycle in most animals and plants.



(a) Use the letters from the diagram to indicate the period(s) when: [3]

(i) chromosomes are being duplicated;

.....

(ii) cell division is taking place;

.....

(iii) interphase occurs.

.....

(b) List **three** processes which take place during interphase. [3]

1. .....

2. .....

3. .....

(c) Explain the change in DNA content in **D** in the diagram. [2]

.....

.....

(d) (i) Can you tell whether the diagram shows meiosis **I** or mitosis? [2]
(Draw a circle around your choice).

Yes No

(ii) Explain your choice.

.....

.....

.....

(e) Give **two** ways in which the chromosomes at the end of meiosis **I** would differ from those at the end of mitosis. [2]

1. .....

.....

2. .....

.....

(Total 12 marks)

11.

The boxes contain events that occur during mitosis, meiosis or both.

A	crossing over between homologous pairs of chromosomes
B	chromatids shorten and thicken
C	centromeres split
D	nuclear membrane disintegrates
E	chiasmata formation
F	unseparated chromatids arranged at cell equator
G	contraction of spindle fibres
H	formation of nuclear membrane

(a) For **mitosis only** put the letters in the boxes below to complete the order in which the events occur. [5]

B					

(b) The horse has a diploid number of 60. Complete the table below for cells produced by mitosis and meiosis in the horse. [2]

	Mitosis	*Meiosis*
Number of chromosomes in nucleus.		
Number of nuclei formed.		

(c) Explain the significance of meiosis to organisms. [3]

.....

.....

.....

.....

.....

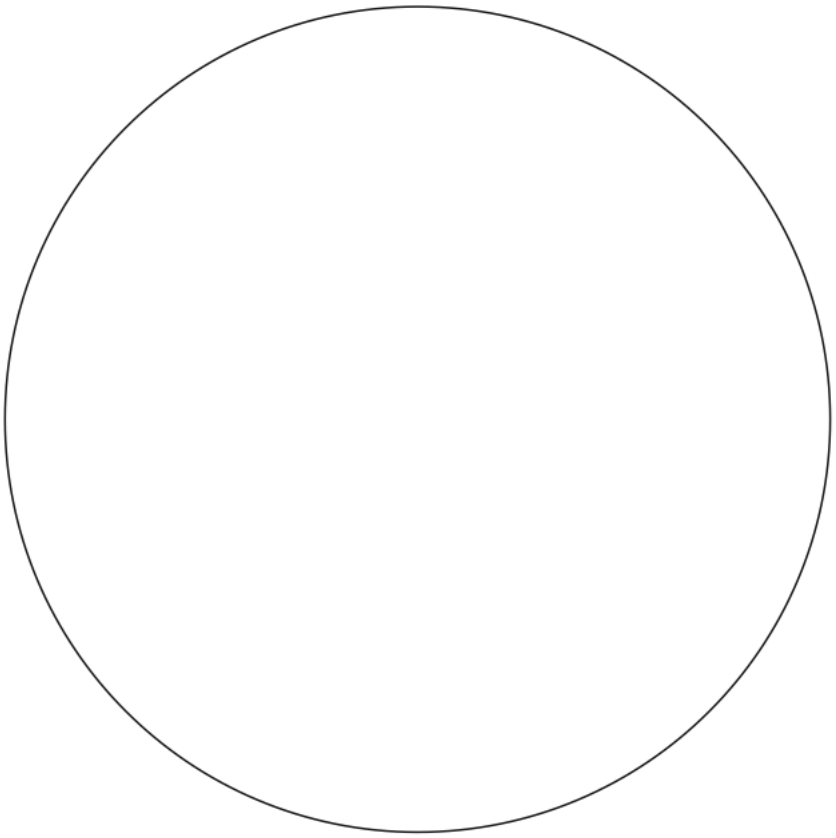
.....

(Total 10 marks)

12.

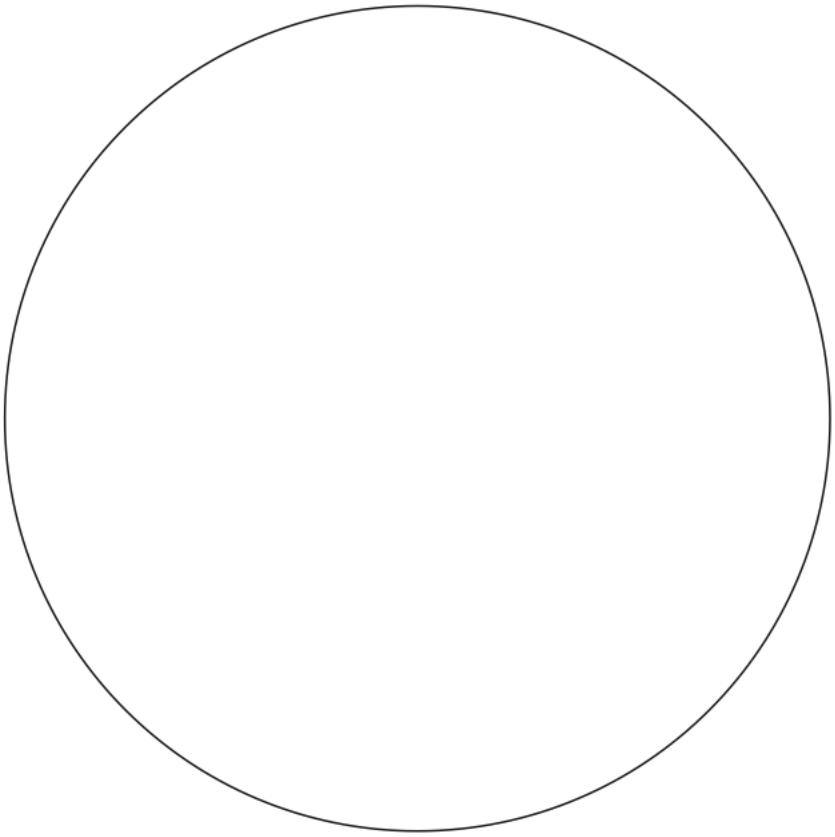
(a) (i) In the outline of the animal cell drawn below, draw a diagram to show the appearance of a cell with the diploid number of 6 chromosomes at metaphase of **mitosis**. Label your diagram fully using the following labels where appropriate.

Chromatids, centrioles, centromere, spindle fibres,
homologous chromosomes/bivalents. [3]



(ii) In the outline of the animal cell drawn below, draw a diagram to show the appearance of a cell with the diploid number of 6 chromosomes at the first metaphase division of **meiosis**. Label your diagram fully using the following labels where appropriate.

Chromatids, centrioles, centromere, spindle fibres,
homologous chromosomes / bivalents. [3]



(b) Independent assortment of chromosomes during meiosis leads to considerable variation. It can be calculated that in the production of gametes in humans (diploid number 46) 2^{23} different gametes can be produced by independent assortment alone.
Calculate the number of different gametes which could be produced by the cell above as the result of independent assortment. Show your workings and give your answer in the form of a whole number. [2]

.....

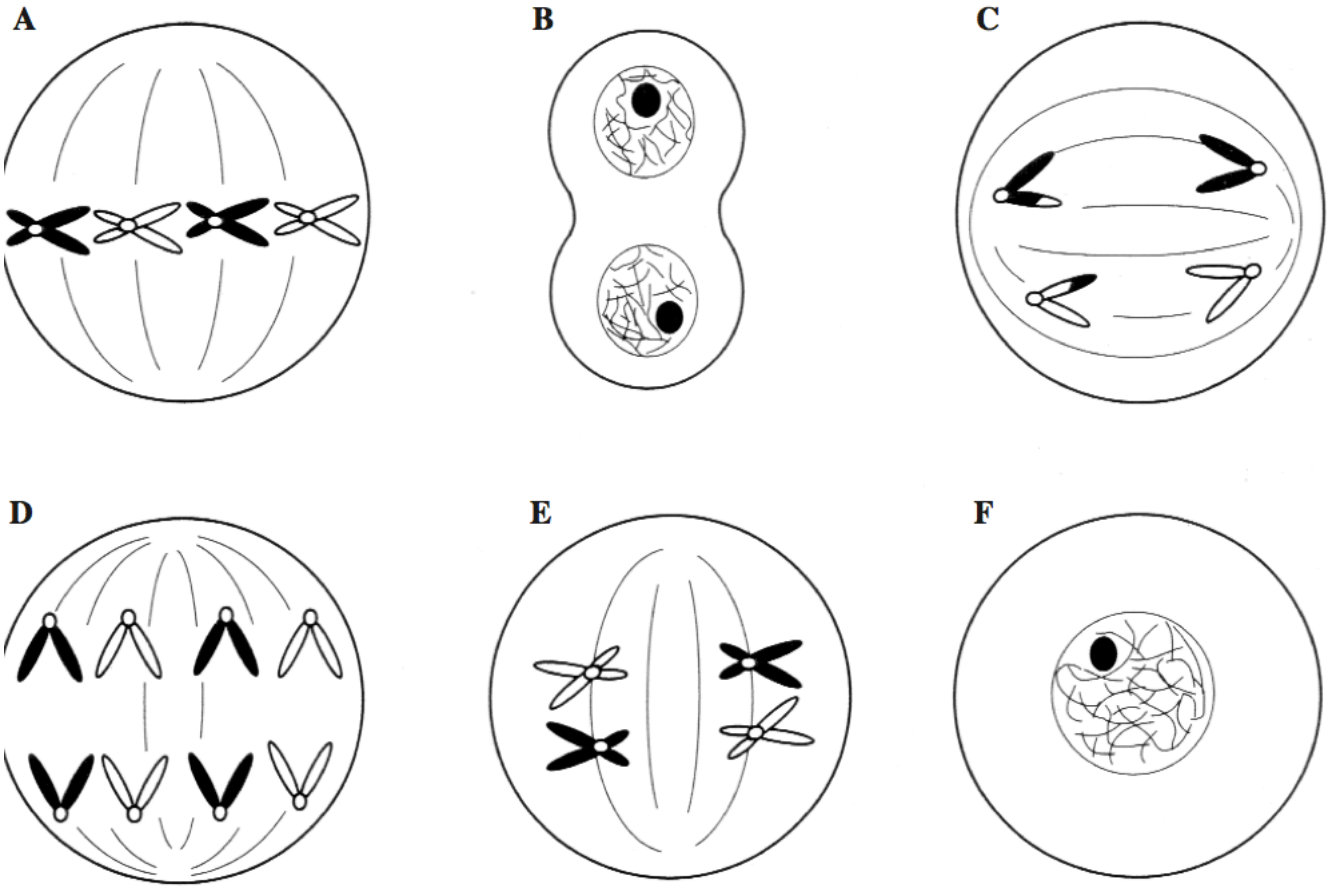
.....

Answer .....

(Total 8 marks)

13.

The drawings show stages in cell division of an organism.



(a) Write a letter **A** to **F** to identify the diagram described by each of the phrases below. Each letter may be used once, more than once or not at all. [6]

(i) metaphase of meiosis; .....

(ii) anaphase of meiosis II; .....

(iii) cytokinesis; .....

(iv) DNA replicates; .....

(v) homologous chromosomes arranged across the equator; .....

(vi) chromosomes show that crossing over has occurred. .....

(b) (i) Name the **type** of cell produced by meiosis. [1]

.....

(ii) Explain why this type of cell is produced by meiosis and not mitosis. [3]

.....

.....

.....

.....

(c) Other than by the process of crossing over, describe how variation occurs. [2]

.....

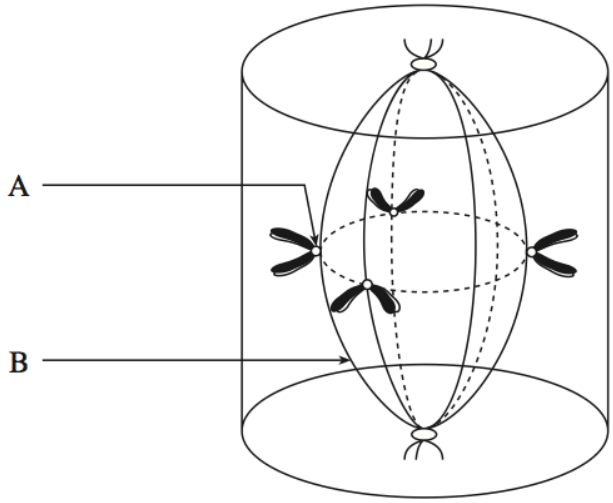
.....

.....

(Total 12 marks)

14.

The diagram shows a three-dimensional view of one of the stages of mitosis in a typical animal cell.



(a) (i) Name the stage shown. [1]

.....

(ii) Name the structure labelled **A**. [1]

.....

(iii) State the function of structure **B**. [1]

.....

(b) Dividing cells undergo a regular pattern of events, known as the cell cycle.
The following statements describe some of the main events taking place in animal cells.
Insert the name of the appropriate stage in the box opposite each statement. [3]

Statement	*Stage in cell cycle*
Chromosomes shorten and thicken and spindle forms	
A period of intense activity which includes the replication of DNA	
Formation of two nuclei	

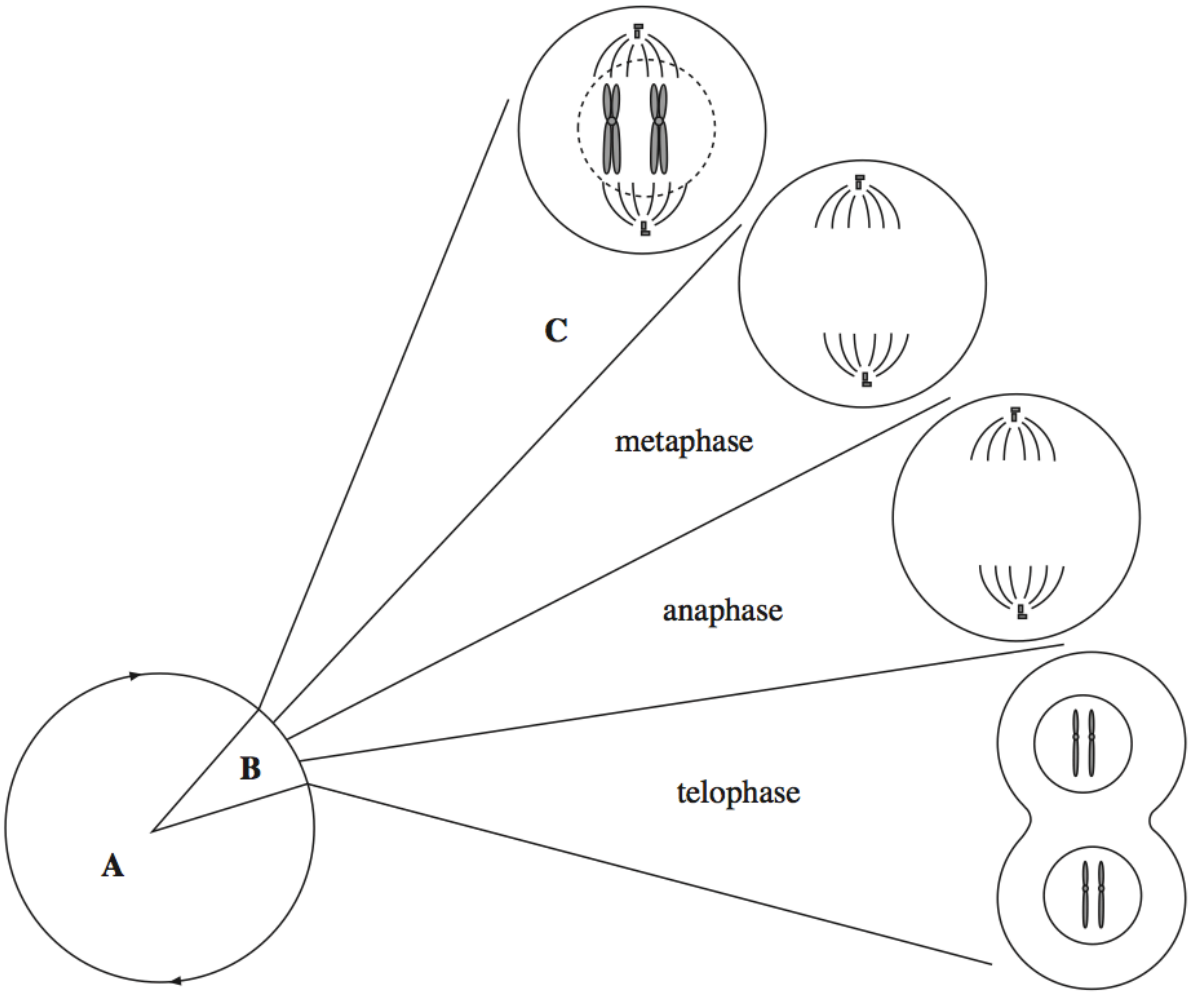
(c) Complete the table to show **three** differences between meiosis and mitosis. [3]

Meiosis	*Mitosis*

(Total 9 marks)

15.

The diagram shows the regular pattern of events that occur in dividing cells.



(a) Name the stages in the cycle labelled **A**, **B** and **C**. [3]

A .....

B .....

C .....

(b) Complete the drawings of the cells in metaphase and anaphase to show how the chromosomes are arranged. [2]

(c) Describe **two** processes that take place during stage **A**. [2]

.....

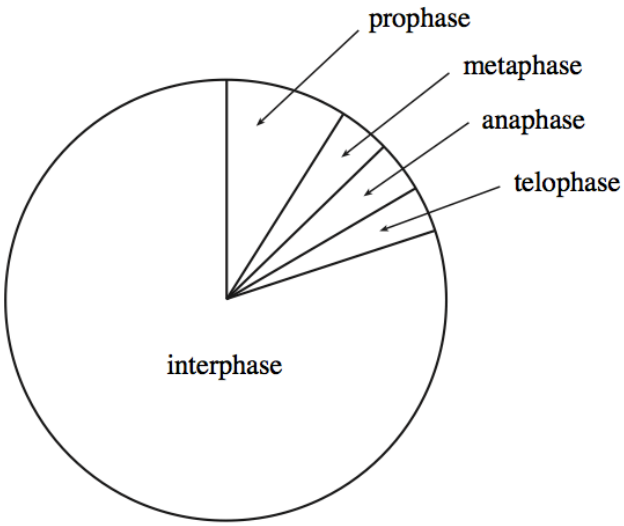
.....

.....

(Total 7 marks)

16.

The drawing shows a simplified diagram of the cell cycle. The size of each segment indicates the relative length of each phase.



(a) (i) Draw an arrow on the diagram to show the correct sequence of events in the cycle. [1]

(ii) On the diagram add a segment to show the point at which cell division (cytokinesis) occurs. [1]

(b) List **four** events that occur during interphase. [4]

.....

.....

.....

.....

(c) Name the stage of mitosis where each of the following occurs.

(i) Chromatids line up at the equator. [1]

.....

(ii) Centromeres split. [1]

.....

(iii) Spindle fibres contract and shorten. [1]

.....

(iv) Chromosomes are first visible as a pair of chromatids. [1]

.....

(v) Nuclear membrane reforms. [1]

.....

(Total 11 marks)

17.

(a) Complete the table to show whether each role applies to mitosis, meiosis or both. If the role applies put a tick (✓) and a cross (×) where it does not apply.

Role	*Mitosis*	*Meiosis*
Involved in growth		
Produces variation		
Produces haploid cells		
Occurs in plants		

[4]

(b) In the space below draw a labelled diagram to show a single chromosome as it appears during prophase of mitosis. [2]

(c) Describe and explain what happens to chromosomes during anaphase of mitosis. [3]

.....

.....

.....

.....

(d) Name the cell organelle responsible for the production of the spindle fibres. [1]

.....

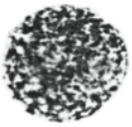
(Total 10 marks)

18.

6. The photographs show chromosomes during the stages of mitosis.

H

I



J

K

L

(a) (i) Place the stages into the correct sequence. The first box has been completed. [1]

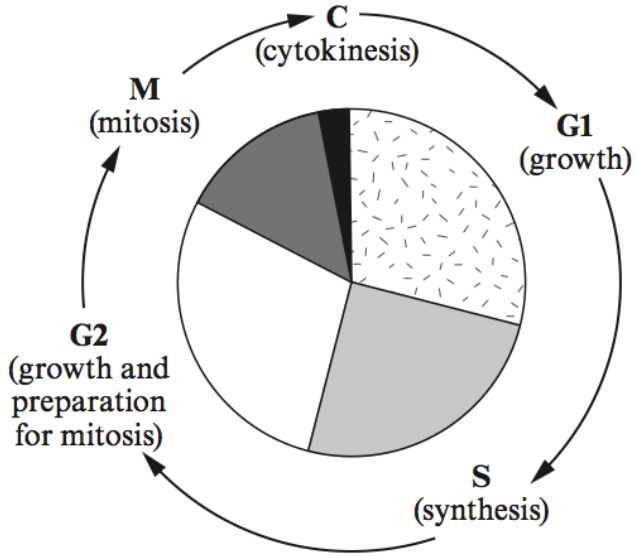
J				

(ii) Name stages: [2]

I .....

L .....

(b) The diagram represents the events that take place during the cell cycle.



The table below shows the DNA content of a cell measured during one cell cycle.

Stage	*DNA content of cell/arbitrary units*
G1	20
S	20 increasing to 40
G2	40
M	40
C	40 decreasing to 20

(i) State the name of the period in the cell cycle that includes stages G1, S and G2.[1]

.....

.....

(ii) State **two** events that occur during this period. [2]

.....

.....

(c) Using information provided in the diagram and the table, explain why it is important that the DNA content of the cell increases during stage **S** and decreases during stage **C**. [2]

.....

.....

.....

(d) Explain how mitosis maintains genetic stability. [2]

.....

.....

.....

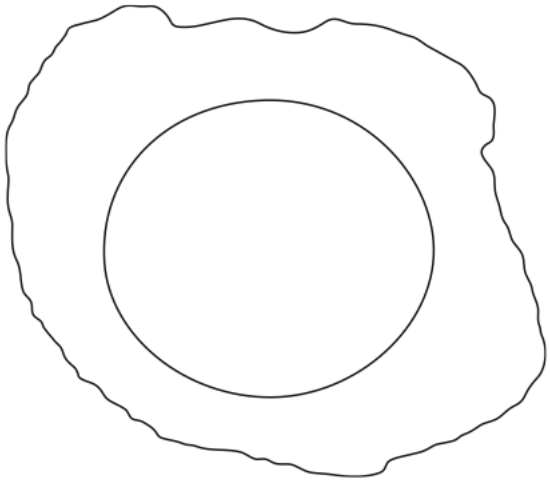
(Total 10 marks)

19.

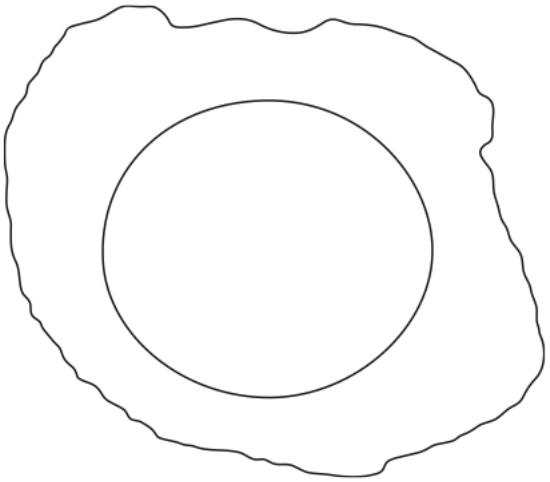
An Australian ant, *Myrmecia pilosula*, carries all its genetic information in a **single pair** of homologous chromosomes. Female worker ants are **diploid**, males are **haploid**.

(a) Complete the drawings of the ant body (somatic) cells below, using drawings similar to structure **A** shown below to represent a single chromosome. [2]

A



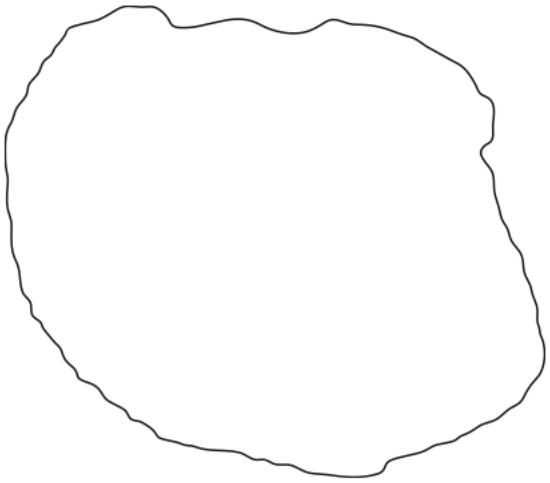
Female worker ant body cell



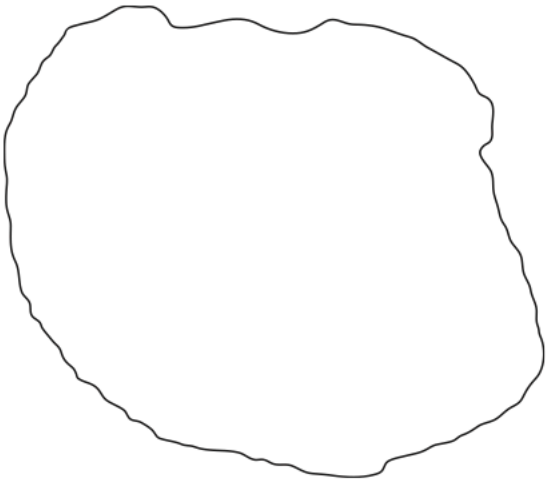
Male ant body cell

(b) Using the cell outlines provided below, make **labelled** drawings to show the appearance of the **female** worker ant cells at the following stages. [4]

(i) **metaphase** of mitosis,



(ii) **anaphase** of mitosis.



(iii) Adult ants emerge from pupae fully grown. Describe the purpose of mitosis in female worker ants. [2]

.....

.....

(iv) Suggest the additional purpose of mitosis in fully grown male ants. [1]

.....

(v) In ant colonies only some ants, called 'queens', produce egg cells and lay eggs. Name the type of cell division that the 'queens' use to produce haploid egg cells. [1]

.....

(vi) What is the significance of the queens producing **haploid** egg cells? [1]

.....

.....

(c) During a mating flight the queen collects sperm cells from male ants, which she stores in an organ called the spermatheca. The haploid egg cells from the queen's ovaries pass the spermatheca as they are laid. Some eggs are fertilised as they pass out, some eggs pass out unfertilised.

How will the ants that develop from fertilised egg cells differ from the ants that develop from unfertilised egg cells? [1]

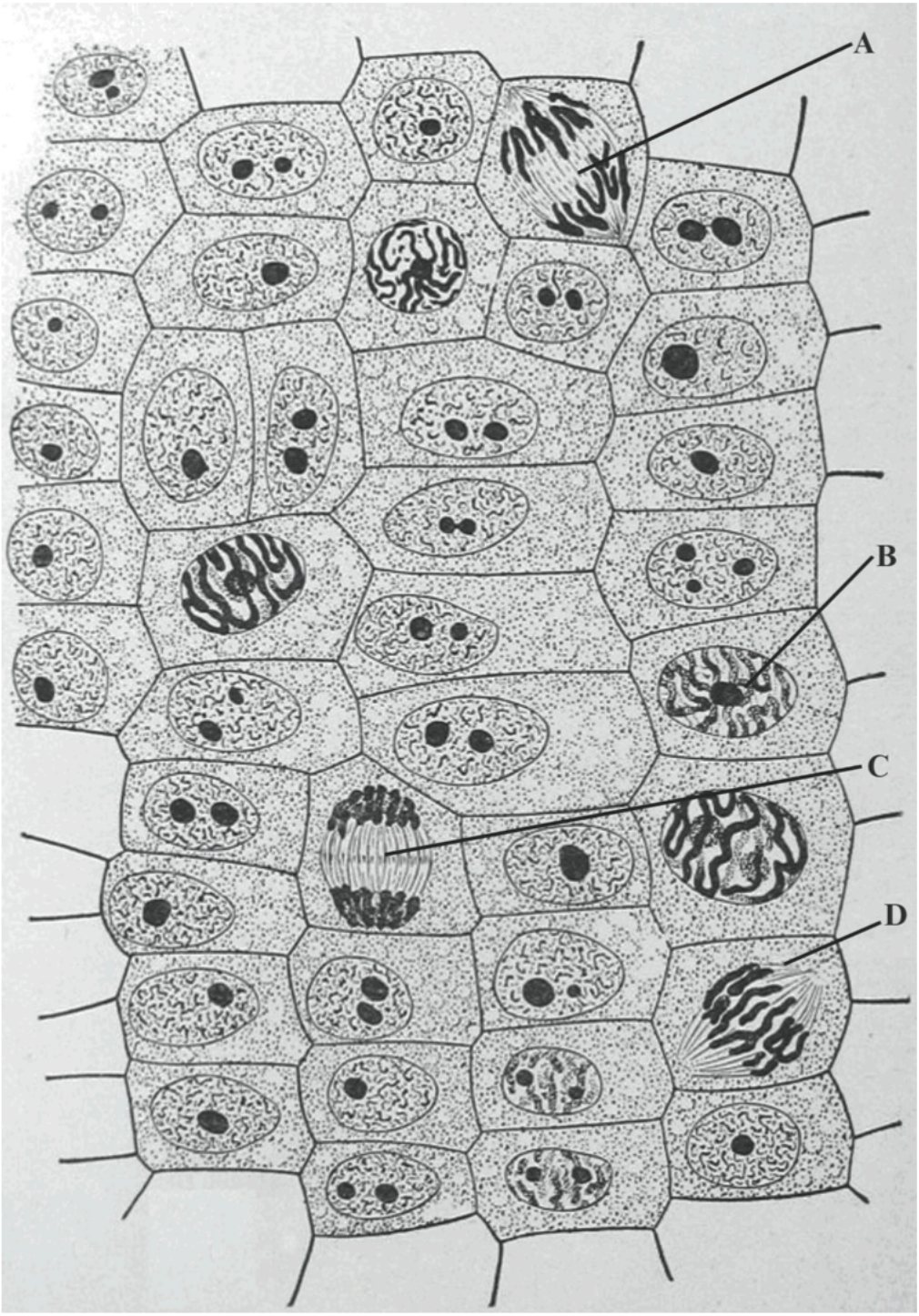
.....

.....

(Total 12 marks)

20.

The drawing below is taken from plant tissue which shows cells undergoing mitosis.



(a) What plant tissue could be observed to produce this drawing? [1]

.....

(b) Identify from the diagram opposite the stages of mitosis labelled **A** to **D**. [4]

A .....

B .....

C .....

D .....

(c) One stage of the **cell cycle** shown on the diagram is present in greater numbers than the others. Name this stage and explain this observation. [2]

Stage: .....

Explanation .....

.....

(d) How would cells produced by meiosis differ from those produced by mitosis? [2]

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.....

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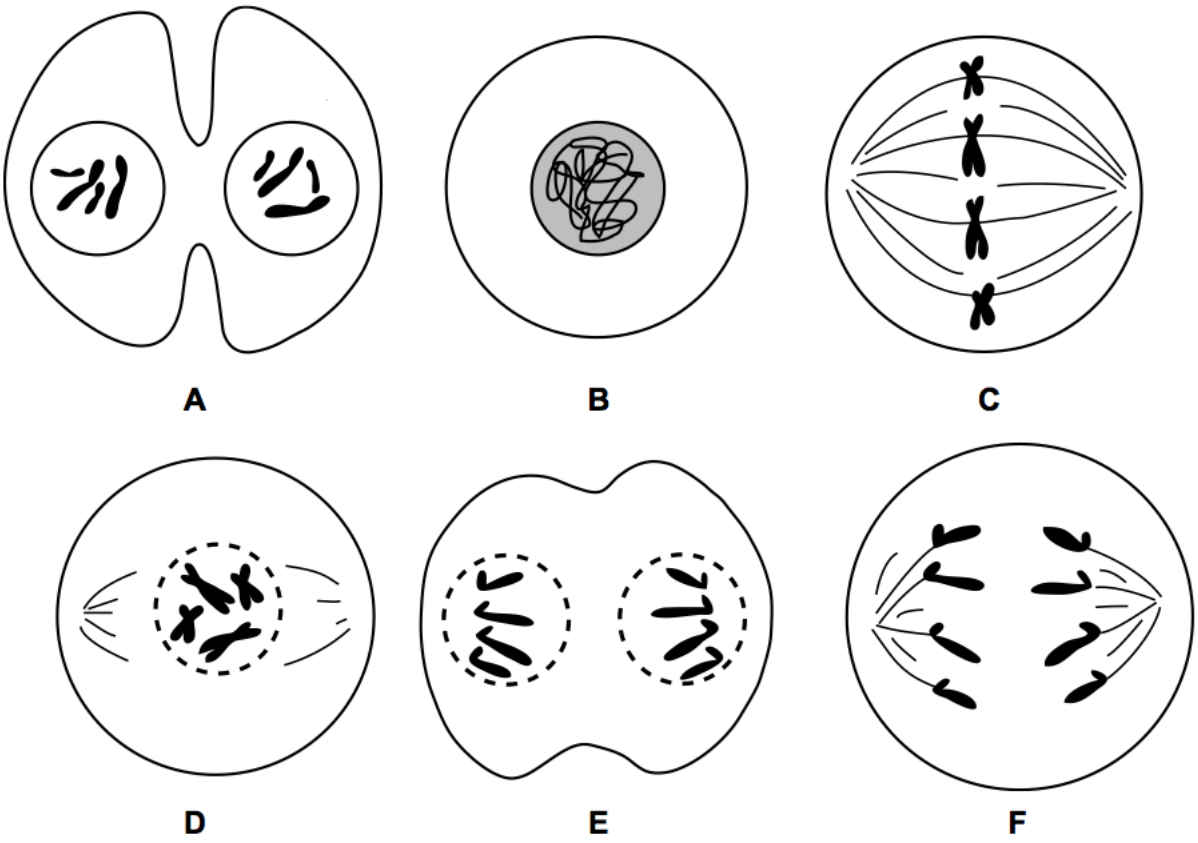
.....

(Total 9 marks)

21.

The diagrams below show the different stages of the cell cycle in a body cell from an animal.



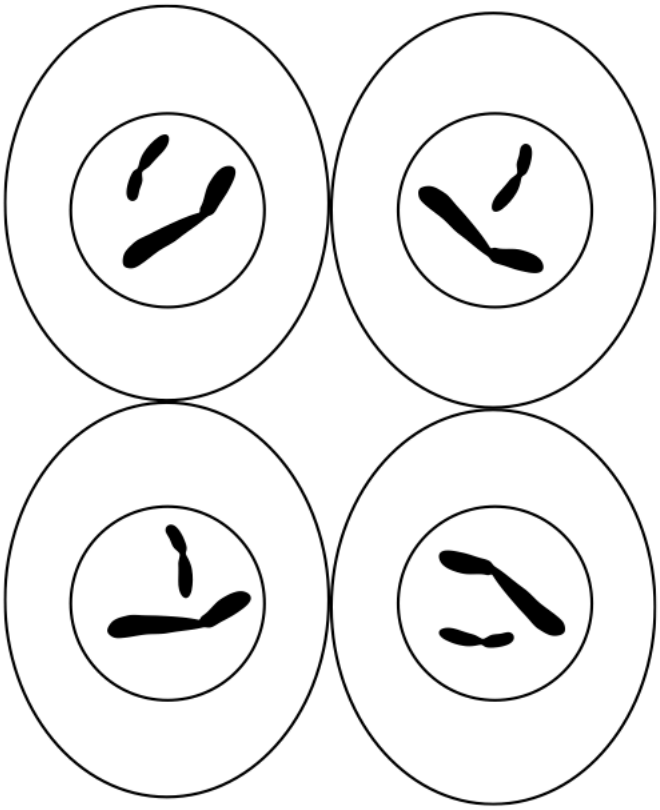
(a) (i) Put the stages from the diagrams above in the correct sequence. The last stage has been done for you. [1]

					A

(ii) Name the process represented in diagram **A**. [1]

.....

Cell division also occurs in the ovaries of animals. The diagram below shows the final stage of cell division in the ovary of the same animal.



(b) (i) Using the diagrams above, describe and explain **one** difference between these cells and those produced in part *(a)* opposite. [2]

(ii) Explain the importance of this type of cell division in the animal. [2]

Essays

1.

(a) Describe the stages in the process of mitosis. [10]

2.

(a) Describe the events that occur during one complete cell cycle including mitosis, in an animal cell. [10]

3.

(a) (i) Describe the functions and importance of mitosis to living organisms using examples where appropriate. [6]

(ii) Describe how meiosis differs from mitosis and explain the significance of these differences. [4]